Determination of Suitable Reintroduction Sites for Tasmanian Devils in Mainland Australia

Introduction
Since the emergence of the Tasmanian Devil Facial Tumour Disease (BFD) in 1996, Tasmanian devil (Sarcophilus harrisii) populations have suffered extreme declines. While captive breeding programs have helped to create an insurance population in case of extinction in the wild, they are costly and require strenuous labor as well as careful coordination to be effective. Wild devil populations would ensure the devil's survival and allow captive breeding programs to focus on other species in need. Relocation of a small group of devils to Maria Island, Tasmania, showed evidence of the captive breed devils successfully adjusting to the wild. While there is controversy of exactly when or how devils went extinct in mainland Australia, scientists believe that it was recent enough for them to assimilate into the current ecosystem without any negative effects on native fauna and may also suppress invasive predators.

Invasive Species Density
Both red fox and feral cats are invasive to Australia and decreasing dingo populations are allowing them to thrive. The density of each was determined by using Kernel Density on population data acquired from Atlas of Living Australia. They were then reclassified and combined using Raster Calculator. Devils are believed to help naturally control these populations through competition and intimidation. Therefore higher densities were ranked as higher suitability since devil relocation to these areas would have a positive ecological impact.

Threatened Species
Due to the high level of predation on small mammals by red fox and feral cats, a total of 13 species were mapped and merged according to their IUCN Red List assessment.

Dingo Density
Dingo population data was acquired from the Atlas of Living Australia. Kernel Density was used and the resulting layer was reclassified.

Land Use
Reintroducing devils into National Parks would allow for protection as well as monitoring. Department of Agriculture and Water Resources land use data was reclassified and combined with Parks and Planets National Park data in order to determine the most suitable parks to reintroduce devils into. Higher suitability was given to areas of minimal use and park locations.

Distance from Mines
Operating mines would cause an immediate threat to devils which make their dens in a variety of places including old burrows. Euclidean Distance was run on data acquired from Geoscience Australia that contains information about the location of mines within 100km.

Population
Tasmanian devil population data from 2011 was acquired from the Australian Bureau of Statistics. Humans can have both positive and negative effects on devils. Since devils are primarily scavengers, they tend to prefer areas near people which makes them highly susceptible to being hit by cars when consuming roadkill. Therefore it was decided that lower populations would be safer and therefore more suitable.

Final Map
A weighted analysis was performed using Raster Calculator giving each factor the following weight:
- 25% Historical Habitat
- 10% Threatened Species
- 5% Human Population
- 5% Land Use
- 15% Dingo Density
- 10% Invasive Species Density

Methods
Historical habitat for Tasmanian Devils in mainland Australia was georeferenced from Rewilding Australia and applied to all maps. Prior to reclassification, Euclidean Distance was run on Threatened Species (all levels of threat were merged). Historical Habitat, and National Parks layers since close proximity to these areas would increase suitability.

Top 3 National Park Reintroduction Sites
Reintroduction of Tasmanian Devils to National Parks is preferred to simplify management of the populations. Devils are also less likely to become roadkill while scavenging due to constant surveillance by park rangers. The practice of removing roadkill before dusk which is currently done in many areas of Tasmania, could also be implemented to further decrease this risk.

Acknowledgements
A generous thank you to Carolyn Talman and for not only giving me reassurance throughout this project, but also inspiring me through her passionate and often hilarious lectures. Those motivational videos sure did wonders, boosting my morale as we struggled with the monter that is GIS. I would like to thank my friends, especially all of my classmates who abided in this struggle. I appreciate you all listening to my rhetorical questions as I attempted to design this creation. Last but not least, shout out to my family for always encouraging me to pursue what I am passionate about, even if it means traveling to the other side of the world.

Nancy McNamara
GIS for Conservation Medicine
December 2016
Department of Geographical and Environmental Sciences, University of Vermont, USA

Tufts University School of Veterinary Medicine